Marginal Marine Mudstones in the Pattani Basin, Gulf of Thailand: Implications for Stratigraphic Development, Reservoir Characterization and Correlation Potential

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Abstract

The lower to middle Miocene late syn-rift to early post-rift sand-dominant strata in the Gulf of Thailand are traditionally viewed as almost exclusively fluvial. The succession includes relatively common, thin "coals" that have been interpreted as floodplain swamp deposits and used extensively for stratigraphic correlation based on their wireline log signatures. Conventional cores from 9 wells across 200 km of the Pattani Basin, and integrated with biostratigraphic and petrographic data, indicate that the "coals" actually comprise three distinct facies, each with a different wireline signature. They are marginal marine mudstones, which are 0.6 - 5.0 m thick laminated clayey siltstones with interbedded thin coals and coaly mudstones, common burrows, organic matter, inner neritic foraminifera and gradational contacts with various adjacent tide-dominant sandy facies. Their log signature includes low resistivity and moderately high density and it can be correlated. Marginal marine coaly mudstones are 0.3 - 1.1 m thick interbedded mudstones and coals with abundant nodular pyrite that have gradational contacts with sandy estuarine deposits. This facies has a distinctive wireline signature featuring high gamma ray values (especially uranium) and spiky transit time curves that can be easily correlated. Nonmarine coaly mudstones are 0.2 - 0.6 m thick with gradational upper and lower contacts with floodplain deposits. Plant debris is abundant and thin coal beds are common. Bed thickness in this facies is often below wireline resolution and it has petrophysical properties that are very similar to floodplain deposits; therefore, it is difficult to identify and correlate with logs. Based on a wireline correlation of 157 wells, marine strata are far more common than previously recognized. There are a number of minor transgressive events within the fluvial-dominant succession plus significant marine transgressions in the lower and middle Miocene. This affects reservoir characterization as many of the stratigraphically adjacent sandstones are tide-dominant or tidally influenced, which affects sand body geometry, connectivity and heterogeneity. Marginal marine mudstones are widely distributed and are good regional markers while marginal marine coaly mudstones and non-marine coaly mudstones are poor markers because they have limited lateral extent and/or are laterally discontinuous.